CONTROL

24/11/2015

Root locus notes :-

1- ts of the over all system = ts of the slowest pole

ζ of the over all system = ζ of the minimum damping (angle)

polar plots:-

Ex :- $G H(s) = \frac{1}{(s+2)(s+1)(s+0.5)}$ find polar plot

Solution

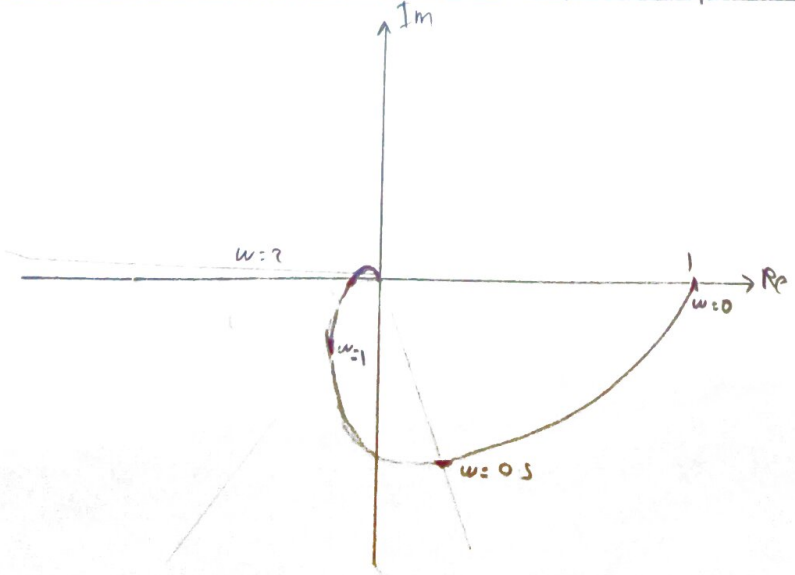
$s \longrightarrow j\omega$, $GH(j\omega) = \frac{1}{(j\omega+2)(j\omega+1)(j\omega+0.5)}$

$$|GH(j\omega)| = \frac{1}{\sqrt{0.5^2+\omega^2}\sqrt{2^2+\omega^2}\sqrt{1+\omega^2}}$$

$$\angle GH(j\omega) = -\angle j\omega+0.5 - \angle j\omega+2 - \angle j\omega+1$$

$$= -\tan^{-1} 2\omega - \tan^{-1}\omega - \tan^{-1} 0.5\omega$$

ω	0	0.5	1	2			∞		
||	1	0.62	0,28	0,077			0		
L	0	-85,6	-135	-184			-270		



Bode diagram

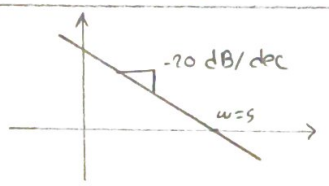
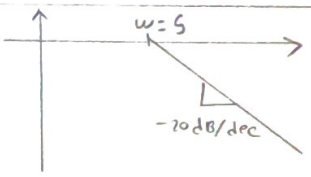
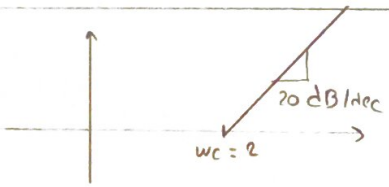
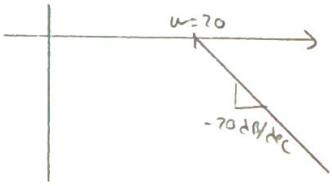
$$GH(s) = \frac{250(s+2)}{s(s+5)(s+20)}$$

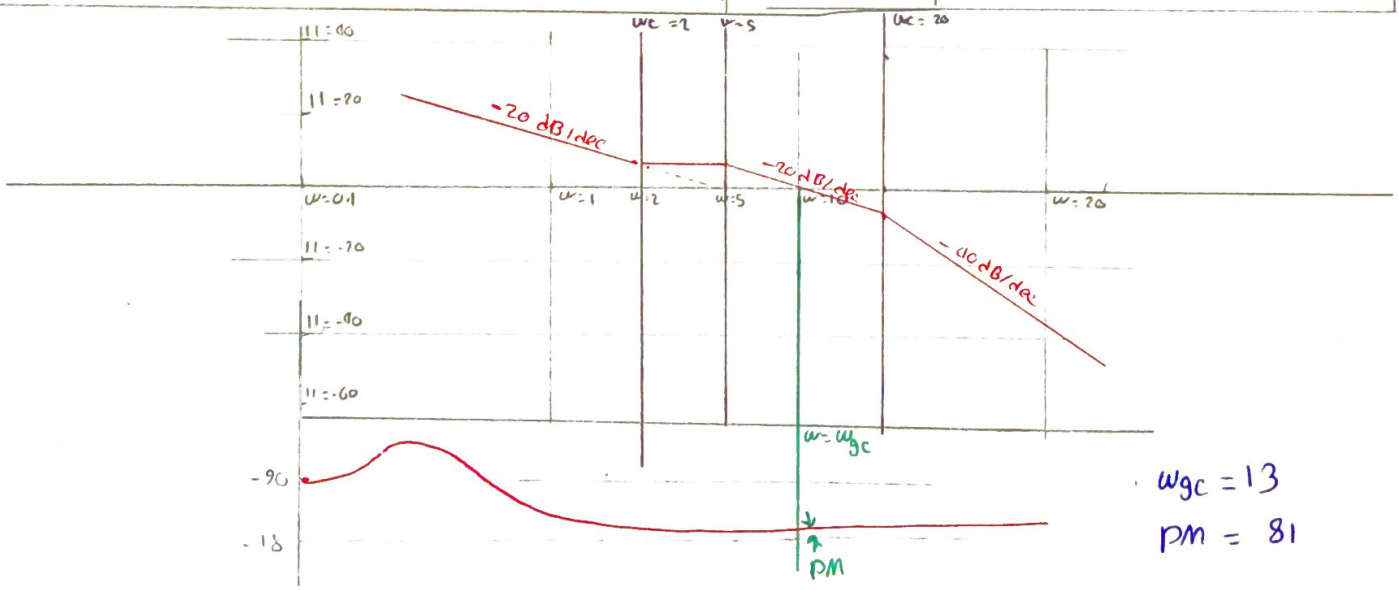
(501.)

$s \longrightarrow j\omega$

$$GH(j\omega) = \frac{250(j\omega+1)}{(j\omega)(j\omega+5)(j\omega+20)} = \frac{250\times 2\left(0.5j\omega+1\right)}{5\times 20(j\omega)\left(\frac{j\omega}{5}+1\right)\left(\frac{j\omega}{20}+1\right)}$$

$$\therefore GH(j\omega) = \frac{5\left(\frac{j\omega}{2}+1\right)}{j\omega\left(\frac{j\omega}{5}+1\right)\left(\frac{j\omega}{20}+1\right)}$$

term	Curve	term	Curve
$\frac{5}{j\omega}$		$\frac{1}{\frac{j\omega}{5}+1}$	
$\frac{j\omega}{2}+1$		$\frac{1}{\frac{j\omega}{20}+1}$	



$\omega_{gc} = 13$

$PM = 81$

$\omega_{pc} = \infty$

$GM = \infty$

$$\angle GH(j\omega) = \tan^{-1}\left(\frac{\omega}{2}\right) - 90 - \tan^{-1}\left(\frac{\omega}{5}\right) - \tan^{-1}\left(\frac{\omega}{20}\right)$$

$$PM = 180 + \angle GH(j\omega)\big|_{\omega=\omega_{gc}}$$